

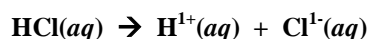
pH and pOH Calculations Practice #1

Part 1: Fill in the missing information in the table below.

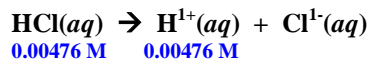
pH	[H ₃ O ¹⁺]	pOH	[OH ¹⁻]	ACID or BASE?
3.78	1.66 x 10 ⁻⁴ M	10.22	6.03 x 10 ⁻¹¹ M	Acid
3.41	3.89 x 10 ⁻⁴ M	10.59	2.57 x 10 ⁻¹¹ M	Acid
		5.19		
	2.04 x 10 ⁻⁹ M	5.31	4.88 x 10 ⁻⁶ M	Base
8.46			2.88 x 10 ⁻⁶ M	Base
	8.45 x 10 ⁻¹³ M			
11.86	1.38 x 10 ⁻¹² M	2.14	7.24 x 10 ⁻³ M	Base
			2.31 x 10 ⁻¹¹ M	
10.91	1.23 x 10 ⁻¹¹ M			Base
	7.49 x 10 ⁻⁶ M	8.87	1.35 x 10 ⁻⁹ M	
4.06	8.71 x 10 ⁻⁵ M	9.94		Acid
			2.57 x 10 ⁻⁸ M	
4.16	6.92 x 10 ⁻⁵ M	9.84	1.45 x 10 ⁻¹⁰ M	Acid
0.98	1.06 x 10 ⁻¹ M	13.0		
10.18		3.82	1.51 x 10 ⁻⁴ M	Base
	1.17 x 10 ⁻⁸ M		8.53 x 10 ⁻⁷ M	

Part 2:

1. A. Write the equation for the dissociation of hydrochloric acid.

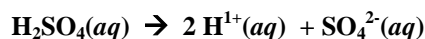


- B. Find the pH of a 0.00476 M hydrochloric acid solution.



$$pH = 2.32$$

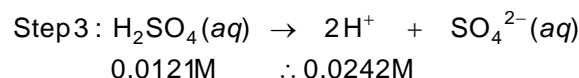
2. A. Write the equation for the dissociation of sulfuric acid.



- B. Find the pH of a solution that contains 3.25 g of H₂SO₄ dissolved in 2.75 liters of solution.

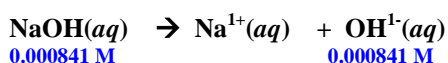
$$\text{Step 1: } x \text{ mol H}_2\text{SO}_4 = 3.25 \text{ g H}_2\text{SO}_4 \left(\frac{1 \text{ mol H}_2\text{SO}_4}{98 \text{ g H}_2\text{SO}_4} \right) = 0.033 \text{ mol H}_2\text{SO}_4$$

$$\text{Step 2: } M = \frac{\text{mol}}{\text{L}} \Rightarrow M = \frac{0.033 \text{ mol H}_2\text{SO}_4}{2.75 \text{ L}} \Rightarrow M = 0.0121 \text{ M H}_2\text{SO}_4$$



$$\text{Step 4: } \text{pH} = -\log[\text{H}^+] \Rightarrow \text{pH} = -\log[0.0242 \text{ M}] \Rightarrow \text{pH} = 1.62$$

3. A. Write the equation for the dissociation of sodium hydroxide.



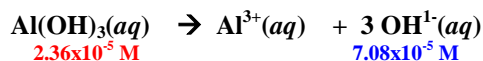
- B. Find the pH of a 0.000841 M solution of sodium hydroxide.

$$\begin{aligned} \text{pOH} &= -\log[\text{OH}^-] & \text{pH} + \text{pOH} &= 14 \\ \text{pOH} &= -\log[0.000841 \text{ M}] & \text{pH} + 3.08 &= 14 \\ \text{pOH} &= 3.08 & \text{pH} &= 10.92 \end{aligned}$$

Or

$$\begin{aligned} K_w &= [\text{H}^+][\text{OH}^-] & \text{pH} &= -\log[\text{H}^+] \\ 1 \times 10^{-14} &= [\text{H}^+][0.000841 \text{ M}] & \text{pH} &= -\log[1.19 \times 10^{-11} \text{ M}] \\ [\text{H}^+] &= [1.19 \times 10^{-11} \text{ M}] & \text{pH} &= 10.92 \end{aligned}$$

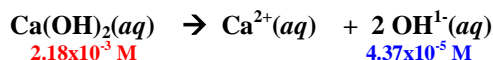
4. A. Write the equation for the dissociation of aluminum hydroxide.



- B. If the pH is 9.85, what is the concentration of the aluminum hydroxide solution?

$$\begin{aligned} \text{pH} + \text{pOH} &= 14 & \text{pOH} &= -\log[\text{OH}^-] & \frac{7.08 \times 10^{-5} \text{ mol OH}^{-1}}{1 \text{ L}} \times \frac{1 \text{ mol Al(OH)}_3}{3 \text{ mol OH}^{-1}} &= 2.36 \times 10^{-5} \text{ M} \\ 9.85 + \text{pOH} &= 14 & 4.15 &= -\log[\text{OH}^-] \\ \text{pOH} &= 4.15 & & & & \\ & & [\text{OH}^-] &= 7.08 \times 10^{-5} \text{ M} & & \end{aligned}$$

5. A. Write the equation for the dissociation of calcium hydroxide.



- B. If the pH is 11.64 and you have 2.55 L of solution, how many grams of calcium hydroxide are in the solution?

$$\begin{aligned} \text{pH} + \text{pOH} &= 14 & \text{pOH} &= -\log[\text{OH}^-] & \frac{2.18 \times 10^{-3} \text{ M}}{2} &= 4.37 \times 10^{-3} \text{ M} \\ 11.64 + \text{pOH} &= 14 & 2.36 &= -\log[\text{OH}^-] \\ \text{pOH} &= 2.36 & & & & \\ & & [\text{OH}^-] &= 4.37 \times 10^{-3} \text{ M} & & \end{aligned}$$

$$M = \frac{\text{mol}}{\text{L}} \Rightarrow 2.18 \times 10^{-3} \text{ M} \Rightarrow \frac{x \text{ mol Ca(OH)}_2}{2.55 \text{ L}} \Rightarrow x = 5.57 \times 10^{-3} \text{ mol Ca(OH)}_2$$

$$x \text{ g Ca(OH)}_2 = 5.57 \times 10^{-3} \text{ mol} \left(\frac{74 \text{ g Ca(OH)}_2}{1 \text{ mol Ca(OH)}_2} \right) = 0.412 \text{ g Ca(OH)}_2$$

